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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/933,304	08/20/2001	Peter Lahnor	6521/83562	5680

7590 07/02/2003

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EXAMINER
VINH, LAN

ART UNIT	PAPER NUMBER
1765	10

DATE MAILED: 07/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/933,304	LAHNOR ET AL.	
	Examiner	Art Unit	
	Lan Vinh	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *3/3/2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. *09/933,304* .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 8, 6, 2 are rejected under 35 U.S.C. 102(e) as being anticipated by Gupta et al (US 6,274,499).

Gupta discloses a method to avoid copper contamination of the intermetal dielectric layer during copper/metal dry etching and CMP (Chemical mechanical polishing). This method comprises the steps of: forming a contact via 17 in the dielectric layer 14 (fig.6), forming a barrier metal layer (titanium) 22/liner over the whole surface/area on a patterned dielectric layer 14 and contact via 17 (col 3, lines 26-53; fig. 7), depositing a metalization layer 26 of copper over the whole surface/area on the metal layer/liner 22 (col 4, lines 31-33), forming a hydrocarbon polymer layer 16 (claimed auxiliary layer) between the liner 22 and the dielectric layer 14 surrounding the contact via 17 (col 3,

lines 31-35, fig. 8), the layer 16 is polished away by CMP (col 4, lines 36-40), removing the metallization layer 26 on the liner 22 and layer 16/auxiliary layer by CMP, the CMP stops on the dielectric layer 14 (col 4, lines 35-48, fig. 9 shows the CMP stops on the dielectric layer 14), the liner layer 22 is broken through by the CMP as shown in fig. 9, performing an etch process to remove layer 16/auxiliary layer (col 5, lines 1-3, fig. 13 of Gupta shows that liner 22 is lifted off when the auxiliary layer 16 is being etched), which reads on an under etch of said liner by removal of the auxiliary layer is effected such that the liner lying thereof is lifted off.

Regarding claim 2, Gupta discloses that perforated hydrocarbon polymer layer 16 has a thickness of between about 500 and 3000 angstrom (col 3, lines 29-31), the thickness of 500 angstrom (50 nm) is encompassed by the claimed range of 20-100 nm.

The limitation of the auxiliary layer is composed of carbon polymer, as recited in claim 6, has been discussed above.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta et al (US 6,274,499) in view of Li et al (US 6,331,479)

Gupta's method has been described above in paragraph 2. Regarding claim 3, Gupta discloses performing a plasma/dry etching step (col 4, lines 65-67). Unlike the instant claim invention as per claim 3, Gupta does not disclose using the layer 16/auxiliary layer partly as a hard mask for the patterning preceding the dry etching.

However, Li discloses a method for forming copper damascene interconnect comprises the step of using the perforated layer 104, deposited between a liner 114 and dielectric layer 100, partly as a hard mask for the patterning preceding the dry etching (col 5, lines 36-67) which reads on using an auxiliary layer partly as a hard mask for the patterning preceding the dry etching.

Since both Gupta and Li are concerned with method of patterning a dielectric layer before dry etching/plasma etching, one skilled in the art would have found it obvious to employ Gupta's layer 16/auxiliary layer as a hard mask for the patterning preceding the dry etching as taught by Li because according to Li the presence of layer 104/hard mask layer protects the dielectric layer from damage due to plasma (col 6, lines 7-9)

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta et al (US 6,274,499) in view of Holland et al (US 6,261,158)

Gupta's method has been described above in paragraph 2. Regarding claim 4, although Gupta discloses performing the polishing process by CMP to reach the layer 16/auxiliary layer, Gupta does not disclose the reaching of the auxiliary layer is detected by an etching stop detection during the CMP process.

However, Holland discloses a multi step CMP method to polish metal layer comprises the step of detecting the reaching of a layer 25 by an etching stop detection signal during the polishing step (col 6, lines 6-9)

Since Gupta is concerned with the step of polishing metal (copper) to reach the layer 16/auxiliary layer, one skilled in the art would have found it obvious to modify Gupta's method by detecting the reaching of layer 16 by an etching stop detection signal during the polishing step in view of Holland's teaching because Holland states that because the metal polishing is stopped when the layer is detected, there is typically some metal recesses , but the amount of metal recesses is less than in the conventional method (col 6, lines 14-17)

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta et al (US 6,274,499) in view of Chen et al (US 6,025,273)

Gupta's method has been described above in paragraph 2. Unlike the instant claimed invention as per claim 5, Gupta does not disclose performing an additional wet –chemical cleaning step at the end of the etching.

However, Chen discloses a method for etching small contact hole comprises the step of performing an additional wet –chemical cleaning step at the end of the etching (col 5, lines 12-33)

Since Gupta is concerned with the step of etching the hydrocarbon polymer layer 16 on the dielectric layer 14 , one skilled in the art would have found it obvious to modify Gupta's method by adding the step of wet –chemical cleaning step at the end of the

etching as per Chen because Chen teaches that the wet etch /cleaning removes any remaining carbon on the surface of the oxide(dielectric) layer (col 5, lines 29-30)

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gupta et al (US 6,274,499) in view of Schwalke et al (US 5,726,094)

Gupta's method has been described above in paragraph 2. Unlike the instant claimed invention as per claim 7, Gupta does not disclose using the hydrocarbon polymer layer 16/ auxiliary layer in conjunction with a CARL resist as bottom resist

However, Schwalke discloses a process for producing a diffusion region adjacent to a recess in a substrate comprises the step of using a layer 6 deposited between a dielectric layer 43 and liner 12 in conjunction with a CARL resist layer 14 as bottom resist (col 4, lines 26-45; col 5, lines 34-41 and fig. 12) which reads on using an auxiliary layer in conjunction with a CARL resist as bottom resist

Since Gupta discloses using the perforated hydrocarbon polymer layer 16/auxiliary layer as a cap layer to prevent copper contamination/diffusion barrier layer (see abstract), one skilled in the art would have found it obvious to modify Gupta method by using the auxiliary layer in conjunction with a CARL resist as bottom resist as per Schwalke because according to Schwalke in order to structure the diffusion layer, a bottom resist layer is preferable applied to the diffusion layer (col 3, lines 10-18)

Response to Arguments

8. Applicant's arguments filed 3/3/2003 have been fully considered but they are not persuasive.

Applicants argue that the reference of Gupta does not teach etching the first dielectric cap layer or any other layer as recited in the amended claims because Gupta teaches that a portion of the first dielectric cap layer 16 (claimed auxiliary layer) is not polished away whereas the claimed invention teaches that the auxiliary layer is under etched in order to lift off the liner lying thereon. First at all, this argument does not commensurate with the scope of claim 8 since claim 8 does not recite the language of "etching the first dielectric cap layer". In addition, this argument is unpersuasive because although the examiner recognizes that Gupta discloses that a portion of the first dielectric cap layer 16 (claimed auxiliary layer) is not polished away, Gupta also discloses the step of etching away dielectric cap 16 and fig. 13 of Gupta clearly shows that the etching step removes layer 16 in order to lift off liner 22 lying thereon. Thus, the examiner asserts that Gupta teaching of etching away dielectric cap 16 to lift off liner 22 reads on the auxiliary layer is under etched in order to lift off the liner lying thereon.

It is also argued that the function of the auxiliary layer of the claimed invention is completely different from what the Examiner has termed the auxiliary layer (dielectric cap layer 16) in Gupta because the claimed auxiliary layer facilitates removal of the liner layer whereas Gupta dielectric cap layer 16 seal the structure and should not be easily removed by the CMP. This argument is unpersuasive because fig. 13 of Gupta clearly shows that the etching step of dielectric cap layer 16 causing/facilitate the lift off of the

liner 22 lying thereon. Furthermore, Gupta also teaches that the dielectric cap layer 16 (the auxiliary layer as termed by the examiner) is polished away by the CMP (col 4, lines 36-40). Hence, the examiner asserts that argued that the function of the auxiliary layer of the claimed invention is not different from what the Examiner has termed the auxiliary layer (dielectric cap layer 16) in Gupta.

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

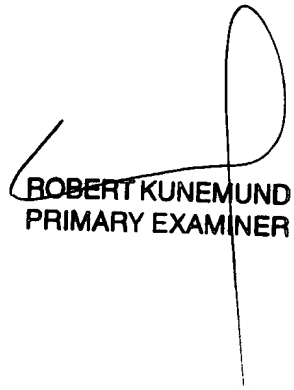
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is 703 305-6302. The examiner can normally be reached on M-F 8:30-5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 703 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308-0661.



LV
June 26, 2003